STUDIES OF THE SWEDISH HETEROBASIDIOMYCETES AND APHYLLOPHORALES WITH SPECIAL REGARD TO THE FAMILY CORTICIACEAE

BY

JOHN ERIKSSON

FIL. LIC., G.-H.

UPPSALA 1958

ALMQVIST & WIKSELLS BOKTRYCKERI AB

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INAUGURAL DISSERTATION

BY

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CONTENTS

Introduction 5
Preface 7
The purpose of the investigation 8
Historical review on corticiology in Sweden 8
Floristic studies 9
Ecological contributions 10
Notes on the distribution of fungi in Sweden 11
Anatomical contributions 12
Remarks on the species concept 13
Systematic arrangements 16
Enumeration of the Swedish corticioid, merulioid, and resupinate hydnoid fungi 17
Corrections and additions 26
References 27

INTRODUCTION

This paper is a summary of the following communications by the author:

I. Något om Hallands Väderös vedbeboende basidiomyceter (English summary). — Kungl. Fysiogr. Sällsk. Lund förh. 18: 8 pp. 1–21, Lund 1948.

II. The Swedish Species of the "*Poria vulgaris*-group". — Sv. Bot. Tidskr. 43: 1 pp. 1–25 pl. I–V, Uppsala 1949.

III. Two New Resupinate *Hymenomycetes* from Sweden. — Ibid. 43: 1 pp. 56–60, Uppsala 1949.

IV. Notes on *Corticium muscicola* Bres. and its Taxonomical Position. — Ibid. 43: 2–3 pp. 310–315, Uppsala 1949.

V. *Peniophora* Cke sect. *Coloratae* Bourd. & Galz. A Taxonomical Study with Special Reference to the Swedish Species. — Symb. Bot. Ups. X: 5 pp. 1–76, Uppsala 1950.

VI. On the Hymenomycetous Genus *Jaapia* Bres. and its Taxonomical Position. — Sv. Bot. Tidskr. 47: 2 pp. 177–189, Uppsala 1953 (together with John Axel Nannfeldt).

VII. *Ramaricium* n. gen., a Corticioid Member of the *Ramaria* Group. — Ibid. 48: 1 pp. 188–198, Uppsala 1954.

VIII. Studies in the *Heterobasidiomycetes* and *Homobasidiomycetes-Aphyllophorales* of Muddus National Park in North Sweden. — Symb. Bot. Ups. XVI:1 pp. 1–172, pl. 1–24, Uppsala 1958.

IX. Studies in *Corticiaceae* (*Botryohypochnus* Donk, *Botryobasidium* Donk, and *Gloeocystidiellum* Donk). — Sv. Bot. Tidskr. 52: 1 pp. 1–17, Uppsala 1958.

These papers will be referred to in this work by their Roman numerals.

PREFACE

The investigation summarized in this paper was performed mainly in the years 1944–1952 at the Institute of Systematic Botany, University of Uppsala. My sincere gratitude is expressed to its Director, Prof. John Axel Nannfeldt, for his kind interest and unlimited benevolence. The cultural work with the *Coloratae* material was carried out at the Institute of Physiological Botany of the same University and I owe my deep thanks to its then Director, Prof. Elias Melin. I am indebted also to my other teachers of botany, Prof. G. Einar Du Rietz, Prof. Nils Fries, Dr Gunnar Degelius, and Dr Nils Hylander. Dr Harry Smith has given me his help with Latin diagnoses and therefore my thanks go to this outstanding botanist. Mr Harald Nilsson and Mr Lennart Andersson have assisted me in the photographical work. Mr Emil Olsson and Mrs Else Eriksson-Klang have accompanied me in Muddus; to these friends of mine my deep gratitude. My thanks are due also to my friends and colleagues at the Institute, Dr Rolf Santesson, Dr Lennart Holm, Dr Olle Hedberg, and Mr Per-Olof Lindahl, as well as to Mrs Carolyn Hörner who has revised the papers printed in 1958 in point of language.

A special tribute of gratefulness is directed to my friend and teacher, Dr Seth Lundell. Thanks to him I became interested in the lower *Hymenomycetes*. I should feel proud if my studies could be looked upon as a continuation of his work.

Contacts with corticiologists in other countries have been of the greatest importance for my studies. I remember above all the late Prof. H. S. Jackson, Toronto, whose deep knowledge and keen criticism made him an outstanding mycologist. Further I take the opportunity of thanking Dr M. A. Donk, Leiden, Dr D. P. Rogers, Urbana, Ill., Dr J. Boidin, Lyon, and Dr A. Pilát, Praha.

My studies have been supported by grants from the University of Uppsala, from "P. E. Lindahls fond", from "Bokförlaget Natur och Kultur", and from "Stiftelsen J. C. Kempes Minne".

And finally I owe my gratefulness to my wife, who has not only endured being married to a corticiologist (a man who fills the house with pieces of rotten wood and other strange things) but even encouraged him in this practice.

John Eriksson

Värnamo, February 1958

THE PURPOSE OF THE INVESTIGATION

My interest focussed from the beginning of my mycological studies on the family *Corticiaceae*. My hope was to give a full account of the family at least in the form of a species list. It is impossible, however, to deal with *Corticiaceae* without having one's interest widened far outside the family, as there are in fact no limits to it and as in nature it occurs together with other resupinates, tempting to studies. Therefore my results deal not only with *Corticiaceae* but also with other families of *Aphyllophorales* (viz. *Polyporaceae*, *Hydnaceae*, *Clavariaceae*, *Hymenochaetaceae*, *Coniophoraceae*, *Thelephoraceae*) and even with *Heterobasidiomycetes*.

To begin with, my interest in *Corticiaceae* was mainly floristic but such studies cannot be performed without much time being devoted to taxonomy. To settle the taxonomical problems, knowledge of the microscopical anatomy of the species is necessary. The collecting trips in different parts of Scandinavia have given me interest in the ecology and the distribution of the species concerned. Again and again questions about species concepts are met with and must be answered. The results are briefly summarized in the ensuing pages.

HISTORICAL REVIEW ON CORTICIOLOGY IN SWEDEN

The history of corticiology in Sweden is very short. Though Swedish mycology includes the great name Elias M. Fries (1794–1878) whose "Systema mycologicum" has been made the starting point of the nomenclature, corticiology made little advance in this country during the 19th century. Species were described, especially by Fries, but as the use of the microscope was not introduced in mycology until later, the knowledge of these fungi remained very vague and superficial. Many of Fries's contributions consisted in attempts to apply to Swedish species, names used by foreign mycologists, before all by Christian Hendrik Persoon (1755–1837), the foremost expert in resupinates of this early period. In Sweden Hampus v. Post (1822–1911) contributed to the knowledge of Swedish *Hymenomycetes* as an industrious collector, also of resupinates. The progress made in other countries was much more important. As corticiology in Sweden to a very high degree has been influenced by impulses from abroad, some words must be said about the general development of this branch of mycology.

Before all there are reasons to mention Franz X. R. von Höhnel (1852–1920) and Giacomo Bresadola (1847–1929). As v. Höhnel gave Litschauer (see below) the incitement to corticiological studies, he has had a special importance for Swedish corticiology. Bresadola can be looked upon as the first modern corticiologist. His work became a model for many later students, as he was a careful collector and his descriptions were intelligible. He influenced many contemporaneous mycologists, i.a. his younger colleague Henri Bourdot (1861–

1937). Bourdot was moreover a representative of the outstanding mycological traditions in France, leading back to Persoon. A famous predecessor to Bourdot was Narcisse T. Patouillard (1854–1926). With Bourdot corticiology reached a milestone in 1928 when "Hyménomycètes de France" appeared as a comprehension of several earlier communications. The traditions from Persoon and Bourdot have been carried further by Marinus A. Donk and finally by Jacques Boidin. In England modern corticiology has its greatest name in Elsie Wakefield, in North America in Herbert Spencer Jackson (1883–1951) and Donald Rogers. In the southern hemisphere corticiology is progressively studied by P. H. B. Talbot in South Africa and by G. H. Cunningham in New Zealand.

The first great name in Swedish corticiology is Lars Romell (1854–1927). Influenced by Bresadola and Karsten and seized by his deep interest in fungi he collected *Hymenomycetes* ardently and untiringly during several decades in different parts of Sweden. His herbarium became a basis for further studies and it is still an important source of knowledge of Swedish resupinates. In buying Bresadola's herbarium he furthered Swedish mycology still more. Romell had not sufficient time or knowledge to be able to order and work over his large material. For this work, Seth Lundell was engaged after Romell's death and with his refined sense for museal work he made Romell's material accessible to all mycologists. At the same time Lundell performed another deed: through his assistance the brilliant Austrian corticiologist Victor Litschauer (1879–1939) was engaged to revise Romell's herbarium. The fundament of Swedish corticiology is thus Romell's collections, arranged by Lundell, and revised by Litschauer. Later-on Lundell has assiduously continued his collections and revisions, parts of which have been published in the "Fungi exsiccati suecici", edited by him and John Axel Nannfeldt.

In Finland the energetic mycologist Peter Adolf Karsten (1834–1917) was an eager collector of also resupinates, and he described numerous species and genera. Later these fungi gained a very talanted student in Matti Laurila (1915–1942) who, however, died too early as a victim of the war.

FLORISTIC STUDIES

In spite of the herbarium material preserved in our museums a.s.o., collected by Romell, Lundell (and his correspondents) as well as by many others, it was clear from the beginning that much more material had to be collected from as divergent parts of Sweden as possible. I have therefore collected resupinates in north Hälsingland, in the neighbourhood of Uppsala, on the island of Hallands Väderö and in the forest Dalby Söderskog in Skåne, in western Jämtland, in Dorotea in the south of Lappland, Abisko and Muddus in the north, and in many other places in Sweden, moreover in Norway and Denmark.

From Hallands Väderö I have published an annotated list (I). Few other places in Sweden are so well suited to studies of lignicolous fungi, as this island is rich in wood substrates of various kinds and its humid and mild climate gives the fungi a long growing period. My collecting was carried out during some short periods and the list is therefore certainly not complete. Later on I had opportunity to visit Hallands Väderö only in the summer and I have found but one additional species of *Aphyllophorales*, viz. *Polyporus* (*Inonotus*) *cuticularis* Bull. ex Fr. The most interesting find is *Auricularia auricula-judae*, for which there is no other with certainty known locality in Sweden. It occurs constantly and profusely on *Sambucus nigra* on the island. *Peniophora detritica* was new to Sweden and so was a species of *Mycoacia*, later described as *M. pinicola* (III). In some few cases my continued studies have led to changes of my determinations, viz.:

Pellicularia pruinata (Bres.) Rogers n. 1087, 1183 is *Botryobasidium candicans* John Erikss. (IX).

Pellicularia vaga (Berk. & Curt.) Rogers is *B. botryosum* (Bres.) John Erikss.

Corticium microsporum (Karst.) Bourd. & Galz. should be included in *Corticium confine* Bourd. & Galz. (= *Cristella confinis* Donk).

I have published only one more account of a special area, viz. that of Muddus National Park (VIII). In this case the collecting was made during several years in a much larger area and the material is thus much richer. But I am convinced that further study here would also result in an increase in the number of species. Several species (29 named and 8 unnamed) in the Muddus list are new to Sweden, among them also some with large and conspicuous fruitbodies. 12 species are described as new. Moreover I have been able to show that some imperfectly known species that had generally been relegated to synonomy are in fact good species e.g. *Polyporus pannocinctus* and *Trametes odora*.

Numerous specimens collected by me have been distributed in Lundell & Nannfeldt: Fungi exsiccati suecici, among them two species described as new: *Peniophora cornea* and *Mycoleptodon robustior* Lundell & John Erikss. New species described in other papers can be found in the list at the end of this paper.

ECOLOGICAL CONTRIBUTIONS

When collecting fungi I have often had reason to think of the circumstances under which they live in nature. Most of the resupinates live on wood, in most cases dead wood, and they could therefore be expected to be more or less independent of several factors affecting other plants (e.g. phanerogams). The presence of wood would be the single claim. This is certainly not the truth. Like other plants they are influenced by a number of environmental factors. In some cases I have published some notes of this kind.

The resupinate flora of Hallands Väderö (I) has been briefly described. Special attention has been drawn to the fungi living on still attached branches, often very high above the ground. This flora of fungi is richer on Hallands Väderö than in most other parts of Sweden. The reason is the high humidity of the air. The fungus flora of the *Alnus* bogs characteristic of the island differs in many respects from the flora of the *Fagus* forest.

In the case of *Sistotrema commune* (IV) another biotope is met with, viz. that of the soil and of the bottom layer (preferably dead or living parts of mosses) in the coniferous forests of Central Sweden. To this ecological niche I had reason to return when dealing with *Ramaricium* (VII). This rare species was found on the bases of *Hylocomia*.

Another singular niche (VI) has *Aegerita candida* as a characteristic species. It grows preferably on twigs of deciduous wood, lying on the ground in small depressions which are filled with water by the autumn precipitation. No resupinate is known to survive drowning, therefore these twigs can house only very short-lived species or such which have special means for survival (in *Aegerita* the granulae). Only one more resupinate known, *Jaapia argillacea*, can grow in such localities. In this species the spores may serve as floating diaspores. In this niche also species not belonging to *Hymenomycetes* are often found, e.g. a little *Aegerita* and some helicospore imperfects.

Ecological notes on the species of *Coloratae* are made in the communications I and V. Several of the species grow preferably on still attached branches and are therefore depending on the humidity. *Peniophora junipericola* is by way of example found almost exclusively near shores (of the sea or of lakes).

In the Muddus paper (VIII) a more profound interest is paid to the ecological factors, especially to the fungus flora of spruces, living or dead. Some observations on the fungus flora in the burnt-over areas are reported and finally comparisons are made between the mycoflora of the Muddus plateau and that of the Stora Luleälv valley. To a number of species reported from Muddus ecological notes are added.

NOTES ON THE DISTRIBUTION OF FUNGI IN SWEDEN

During collecting trips in different parts of Scandinavia I have often been struck by the differences in the fungus flora met with. Some species are the same in Muddus and on Hallands Väderö (to take the extremes) but most of them are not. Moreover species occur in very different frequences in different parts of the country.

Too little is still known about the distribution of fungi in Sweden and of their frequences, but yet some conclusions can be drawn from the material available, and in the Muddus paper (VIII) I have made an attempt to group the species

according to their distribution and frequency. No doubt, continued study of the *Corticiaceae* of Sweden would lead to many changes in these lists but I hope that they will to some degree arouse interest in the problem. As a final result I came to a little group of species (a taiga element) very characteristic for Muddus but more or less unknown in other, more southern parts of the country. These fungi occur also in north Finland and Russia, in the interior part of Norway, in the Carpathians, and in North America. All these areas have a continental climate in common and the localities have a vegetation of more or less virgin coniferous forests.

On a collecting trip to western Norway I found that several species of *Aphyllophorales*, which in Sweden are restricted to the southernmost parts, on the west coast of Scandinavia extend farther to the north. Species like *Coriolus hirsutus* and *versicolor* which are rare in the vicinity of Uppsala, are very common in suitable localities at Trondheim, farther to the north. The find of a singular species, *Corticium coeruleum*, for which in Scandinavia no locality is known outside this western coast region, makes it probable that also among *Aphyllophorales* there exists an oceanic element.

In 1948 (I) I chose some species as examples on fungi that occur frequently all over Sweden, where only suitable wood débris exists. Two of these species have proved to be rare in the northern part of the conifer region of Norrland: *Peniophora incarnata* and *Gloeocystidiellum citrinum*. Among the species I then looked upon as very rare I have had to change my opinion for one, viz. *Corticium* (*Xenasma*) *tulasnelloideum*, which has proved to be common on *Fagus* wood in southernmost Sweden.

ANATOMICAL CONTRIBUTIONS

The taxonomical study of resupinate *Hymenomycetes* is mainly a study of their microscopic anatomy. All descriptions and figures are thus contributions to the knowledge of their anatomy. For some species the anatomical study has been performed with special care. The following can be mentioned as examples: the species of the "*Poria vulgaris*-group" (II), the species of *Peniophora* sect. *Coloratae* (V), *Sterellum pini* and *rufum*, *Stereum sulcatum* and *Murraii*, *Trametes odora* and *suaveolens*, *Poria Stellae* and *tschulymica*, and *Gloeoporus pannocinctus* (VIII).

The basidium attracts interest in a special degree as basidial characters often give good holds for the discussion of the taxonomy of these fungi. The shape of the basidium is the most important character of the genus *Sistotrema* as already pointed out by Bourdot & Galzin (1928). It contributes essentially to the recognition of *Hyphoderma* em. Donk (1957), *Hypochnicium* and *Hyphodontia* (VIII). The subgenera of *Botryobasidium* (IX) is to some degree characterized by different basidia. A special kind of basidium formation—through linear repetition—is the

most prominent feature of *Repetobasidium* (VIII). *Sistotrema* was characterized i.a. by the number of sterigmata, which is more than 4 (6–8). The same is true of *Sistotremastrum* (VIII) and *Paullicorticium* (VIII). Also for *Aleurodiscus*, *Cristella*, and *Xenasma* the shape of the basidium is of importance for the diagnosing.

It has long been accepted that shape, size, sculpture etc. of the spores are of significance for the recognition of species. To some degree the nature of spores also contributes to the taxonomy of higher taxa. *Ramaricium* (VII) is placed in the vicinity of *Ramaria* mainly on account of the nature of the spores. In the same paper the spore sculpture of other corticioid fungi is discussed. The genus *Jaapia* (VI) has double-walled spores. The inner layer of the wall reacts to cotton-blue. This characteristic as well as others afford reasons for placing *Pellicularia ochroleuca* in *Jaapia*. On account of the nature of the spores it seems natural to refer *Jaapia* to *Coniophoraceae*.

A hyphal character is the main distinctive mark for *Scytinostroma* Donk. A similar property is the motive of *Fibricium* (VIII).

REMARKS ON THE SPECIES CONCEPT

It is always very difficult to express an opinion about the species concept. As, however, a taxonomist deals mainly with species, it is necessary for him to have a species concept, even if it is more or less intuitive and subjective. When I determine different samples as belonging to one species, this means to me that I find them to differ very little from each other and to form together an entity, the species, which is distinct from other comparable entities. As *Basidiomycetes* normally are heterothallic and produce fruitbodies from dikaryotic mycelia, arisen from the combination of two monosporous mycelia, it is possible to formulate a more precise and more objective species concept for these plants. An equality sign could be put between species and intersterile groups. Two monosporous mycelia which may fuse and produce a dikaryotic mycelium, could be considered as belonging to one species while two monosporous mycelia which on combining do not form dikaryotic mycelia either belong to different species or to incompatible groups within one species (e.g. represent the same sexual group). Thus it is possible to study species with regard to the behavior of their monosporous mycelia and in this way to decide the specific delimitation. This method was proposed already by Vandendries in 1923 (surveys in Quintanilha & Pinto-Lopes 1950 and in Lange 1952) and I have used it to get a better idea of the taxonomy of *Peniophora* sect. *Coloratae* (V). In this section I was first inclined to use a wider species concept, but the behavior of the monosporous mycelia in culture pointed towards a narrower species concept. I have also used the method to show that two very different forms of *Peniophora candida* Lyman are conspecific (Lundell & Nannfeldt: Fung. exs. suec. n. 2133).

This species concept is founded on the idea that specifically distinct mycelia do not fuse and form dikaryons. This is not quite self-evident. Higher plants form hybrids. Why should not *Hymenomycetes* also? Suppose the case that intraspecific combinations result in dikaryotic mycelia better suited for surviving than interspecific combinations, then we should nevertheless have reason to speak of distinct species, as these fungi would act as species in nature. Other possibilities might also be supposed, e.g. that specifically distinct monosporous mycelia are interfertile in so far that they may fuse and form dikaryons but that the dikaryotic mycelia are unable to form basidia in which normal meiosis can take place. Moreover, it may happen that monosporous mycelia combine irregularly, under certain circumstances etc. and not in obligate polarity schemes. With regard to these objections it cannot by itself be certain that two samples belong to one species, only because interfertile monosporous mycelia can be obtained from them. Against these objections, on the other hand, there stand experiences from very numerous combination tests, carried out by several mycologists. These experiments show that within a morphologically homogeneous material fusion and dikaryon formation are regular and that morphologically distinct groups also are intersterile. For a heterogeneous material the behavior of the monosporous mycelia is thus of the greatest importance for the understanding of its taxonomy. The complications—briefly discussed above—which could interfere with the interaction of the monosporous mycelia, would as a rule result in a too wide species concept, but in reality the species concept based on intersterility groups becomes on the contrary sometimes too narrow (Biggs 1937, Lange 1932) for practical purposes. As reported below it seems possible that the species concept found by me for the gloeocystidiate species (*Peniophora nuda* and *violaceolivida*) is impractically narrow when it concerns a larger material. It is often a fact that taxonomical results reached in a restricted area are not simply applicable on a taxon in its whole range. This does not mean that taxonomical studies in restricted areas are without value. On the contrary it is often necessary to start with geographically very limited areas when difficult groups are dealt with.

Within a restricted area taxa may behave as good species, but if they are studied in their whole geographical range, they may be found to be connected by intermediates (intermediate both morphologically and with regard to the behavior of monosporous mycelia). When dealing with a restricted area such distinct taxa must be given some designation. I have therefore treated the form of *Phellinus pini* on spruce as a variety, *abietis* (in Muddus it behaves as a good species) and in the same way I have treated *Hirschioporus abietinus* var. *abietis* (VIII). Haddow (1938) showed the forms of *Ph. pini* to be conspecific and Raestad (1941) arrived at the same result for *H. abietinus*.

Homothallic species can produce fruitbodies without pairing of monosporous mycelia, and there exists a possibility for the survival of mutants as "small-

species"—as in apogamous phanerogams. This evidently influences the species concept and may be the reason for the taxonomical difficulties in some species groups, e.g. the interimistic genus *Membranicium* (VIII). In the case of homothallic resupinates JACKSON (1948 p. 130) can be cited: "It seems probable that homothallic forms in the *Basidiomycetes* have derived from heterothallic ones by occasional haplonts changing in such a manner that the full life and nuclear cycle is carried out on a thallus originating from a single-nucleated spore. This may perhaps be brought about by mutation either in the haplont or the dikaryotic diplont. In any given heterothallic form in which such a tendency developed, a series of 'shortcycled' mutants might originate successively or perhaps intermittently. Originating in this manner there might well be a tendency for variations inherent in the parent heterothallic species to be sorted out and fixed in the resulting of homozygous lines. In the parent heterozygous form, because of repeated hybridization, such inherent variation would not be so noticeable when several collections are compared".

"First orbicular, then confluent" is a description that fits for many resupinates. That means that the fruitbodies are formed by several primordia which grow larger and at last flow together. A consequence of this manner of growth is that the samples are not of necessity always homogenous. Both dikaryotic and monokaryotic mycelia are in culture found to intermingle and it is certainly not impossible for such mycelia (composed of two or several strains) to produce fruitbodies. When investigating preparations of *Tomentella* I have sometimes found hymenia being composed by hyphae and basidia belonging to well distinguished species. I do not think, however, that such "graft hybrids" are so common that they are of importance for a practical species concept.

Because, to some degree, the delimitation of genera depends upon personal judgement, different mycologists may have different opinions about the delimitation of various species. In some cases I have used a narrow species concept (e.g. *Sistotrema commune*, IV), in others a wider one (e.g. *Cristella farinacea*, VIII). That depends upon the fact that in the former case I think that I have found good limits for a small taxon and in the second case I have been unable to find such. Small taxa are to be preferred if they are only well limited, for they are more uniform and allow thus more exact conclusions to be drawn on ecological, physiological and other properties. On the other hand small taxa often make it more difficult to name a given sample and this matter must not be forgotten. When my paper on *Coloratae* had been published, I received from many parts of the world material for determination. In some respects I found it difficult to apply my experience from the Swedish material. This was true especially with regard to the gloeocystidiate members of the *Peniophora cinerea*-group in a rather extensive North American material. In this case there might perhaps be reasons for a wider species concept.

SYSTEMATIC ARRANGEMENTS

Resupinate *Hymenomycetes* do not form a homogeneous group. Even the corticioid resupinates cannot be grouped in a taxon of their own. Corticioid species are found in *Coniophoraceae*, *Hymenochaetaceae*, *Thelephoraceae*, and *Corticiaceae*. *Ramaricium* (VII) can be regarded as a corticioid genus of *Clavariaceae*. On the other hand *Corticiaceae* cannot be restricted to corticioid species—in this family also species with merulioid, phlebioid and hydnoid hymenium must be placed (VIII).

Traditionally, *Corticiaceae* were devided into some few artificial large genera (except some small genera, also these traditional, e.g. *Cytidia*). Successively, genera have been segregated that are more natural but it was not until 1956 that this new view was more consequently applied. At that date DONK began describing natural new genera (*Tubulicrinis*, *Laeticorticium*, and *Scytinostroma*) and emending old ones to more natural taxa (*Gloeocystidiellum* and *Sistotrema*). He continued in 1957 with the natural new genera *Tylosperma* and *Xenasma* and the emended genera *Athelia*, *Cristella*, *Hyphoderma*, *Peniophora*, and *Phlebia*. I had been working along the same lines for several years and added in 1958 *Sistotremastrum*, *Repetobasidium*, *Paullicorticium*, *Hypochnicium*, *Fibricium*, and *Hyphodontia* (VIII). Still other natural groups will certainly be segregated as natural genera (e.g. *Corticium laetum* and related species = *Corticium* sect. *Laeta* BOURD. & GALZ.). I have listed one natural group under a provisory name (*Membranicium* ad int., VIII).

Just as in the case of families, the delimitation of genera varies from taxonomist to taxonomist. This is inevitable especially for *Corticiaceae* which are still too little studied. It matters very little if natural groups are treated as genera of their own or joined to larger genera. They should not, however, be too large for in such cases it becomes very difficult to get a survey of them (e.g. *Corticium* and *Peniophora* as artificial genera for non-cystidiate and cystidiate species respectively). As a rule segregation of a group as a genus of its own highly stimulates the interest in it. There are some good examples of this effect. The genus *Botryobasidium* (*Pellicularia*) has been treated by several authors since it was made a genus of its own. *Peniophora* sect. *Coloratae* attracted few students until my paper was published in 1950 (V) but since then several contributions (anatomical, cytological, geographic) have been made to the genus. The known area has been considerably widened for some species—*Peniophora septentrionalis* is found in America, *P. proxima* and *versicolor* are collected in England. *P. lilacea* has been refound in France and so this doubtful species can be studied more profoundly. An older example is found in *Aleurodiscus* which is nowadays a rather well known genus. We have a rather clear concept of the genus *Sistotrema* em. DONK thanks

to its early segregation. It is my hope that the new genera published by Donk and myself shall have the same effect.

Even if the natural genera as a rule are not very large, it is sometimes a help for the survey and thus for the diagnosing if they can be subdivided. I have tried this for *Peniophora* (V) which resolves itself into small, natural parts. Some of them have later been discussed as genera of their own. I have also proposed a subdividing of *Botryobasidium* (IX) into three subgenera, based on basidial and hyphal characteristics, and treated the closely related *Botryohypochnus* as a genus of its own (IX).

ENUMERATION OF THE SWEDISH CORTICIOID, MERULIOID, AND RESUPINATE HYDNOID FUNGI

One of the goals of my studies has been to contribute as complete as possible a list of the Swedish resupinates (especially *Corticiaceae*). Such a list would be of use not only to the taxonomists interested in this group, but also to forest pathologists, physiologists and other students. As very often happens, however, things developed in another direction than I thought in 1944 when I started as a corticiologist. I have collected material in much more restricted degree than I hoped from the beginning and I have revised much fewer of the species and genera than could be wished. Nevertheless, if I compile my notes, the result is a list. This is certainly incomplete, but so far as I understand this is a defect common to all "first lists". There are surely species that I have missed for one reason or another. Old species will certainly be split, others will be reduced to synonomy and, above all, additional species will be found. If corticiology will be studied also in the future in Sweden, I am sure that my list will be looked upon as out of date very soon.

As corticioid fungi cannot be kept separate from closely related species with merulioid or hydnoid hymenium, I have had to include all species with corticioid and merulioid hymenia, as well as all resupinates with a hydnoid hymenium. Poroid fungi are not dealt with (the only exception is *Cristella candidissima*).

For several species the combinations have not been made for the genus under which they are enumerated. Many of them are species that are not sufficiently known as yet. The list is naked, without comments, but some notes on the delimitation of the genera as well as on numerous species can be found in the Muddus paper (VIII). Here comments will be made on only one further point, which concerns *Peniophora aurantiaca*. When I investigated my scarce material of this species (V), I found that in some specimens the hyphae were provided with clamps while other specimens lacked clamps altogether. Recently Boidin (1957) when studying a richer material, has found reason to distinguish two species in the material, *P. aurantiaca* with clamps and a new species, named

P. Erikssonii, without clamps. He found them to differ also in distribution and as to substrate. *P. aurantiaca* prefers *Alnus viridis* and related species of *Alnus*, while *P. Erikssonii* grows on *A. glutinosa* and *incana*. The three collections known in Sweden in 1950 belong to *P. Erikssonii*. Later I have collected the species some times (very rich occurrances) and I have come to the opinion that *P. Erikssonii* is a rather common species on fallen or still attached branches of *Alnus*.

In the list the genera of *Corticiaceae* are arranged according to the following provisory classification in subfamilies:

Botryobasidioideae: *Cerinomyces, Ceratobasidium, Uthatobasidium, Botryohypochnus, Thanatephorus, Botryobasidium, Oideum.*
Sistotremoideae: *Sistotrema, Sistotremastrum.*
Cristelloideae: *Cristella, Xenasma, Paullicorticium.*
Repetobasidioideae: *Repetobasidium.*
Galzinioideae: *Galzinia, Scytinostroma, Vararia, Laeticorticium.*
Aleurodiscoideae: *Gloeocystidiellum, Laxitextum, Aleurodiscus, Vuilleminia, Cytidia.*
Tubulicrinoideae: *Tubulicrinis.*
Athelioideae: *Athelia, Byssocorticium, Tylosperma.*
Phlebioideae: *Phlebia, Mycoacia, Membranicium.*
Peniophoroideae: *Peniophora, Sterellum.*
Hyphodermoideae: *Hyphoderma, Hypochnicium, Hyphodontia, Amphinema, Fibricium.*
Corticioideae: *Corticium* sect. *Laeta, Corticium.*
Odontioideae: *Dacryobolus, Odontia.*
Merulioideae: *Merulius.*
Stereoideae: *Stereum, Lopharia, Podoscypha, Plicatura, Cotylidia.*

The four last subfamilies are artificial.

Corticiaceae.

Cerinomyces Martin

C. crustulinus (Bourd. & Galz.) Martin

Ceratobasidium Rogers

C. atratum (Bres.) Rogers
C. cornigerum (Bourd.) Rogers
C. sterigmaticum (Bourd.) Rogers

Uthatobasidium Donk

Published without binomials.
Botryobasidium flavescens (Bon.) Rogers
B. ochraceum (Mass.) Donk ex Rogers

Botryohypochnus Donk

B. isabellinus (Fr.) John Erikss. (IX)

Thanatephorus Donk

Th. cucumeris (Frank) Donk

Botryobasidium Donk

Subg. *Botryobasidium* (Donk) John Erikss. (VIII)

B. angustisporum (Boidin) John Erikss. (VIII)
B. subcoronatum (v. Höhn. & Litsch.) Donk

Subg. *Brevibasidium* John Erikss. (VIII)

B. botryosum (Bres.) John Erikss. (VIII)
B. candicans John Erikss. (*Oidium candicans* (Sacc.) Linder) (IX)
B. conspersum John Erikss. (*Oidium conspersum* (Link) Linder) (VIII)
B. medium John Erikss. (*Oidium sp.*) (VIII)
B. obtusisporum John Erikss. (VIII)

Subg. *Dimorphonema* John Erikss. (IX)

B. pruinatum (Bres.) John Erikss. (IX) var. *laeve* John Erikss. (IX)
B. heteronemum John Erikss. (IX)

Oidium Link ex Fr.

O. aureum Link

Sistotrema Donk

S. alboluteum (Bourd. & Galz.) Bond. & Sing.
S. Brinkmannii (Bres.) John Erikss. (I)
S. commune John Erikss. (IV)
f. *efibulatum* John Erikss. (IV)
S. confluens Pers. ex Fr.
S. coroniferum (v. Höhn. & Litsch.) Donk
S. diademiferum (Bourd. & Galz.) Donk
S. muscicola (Bres.) Lundell
S. raduloides (Karst.) Donk
S. Sernanderi (Litsch.) Donk
S. subtrigonospermum Rogers

Sistotremastrum John Erikss. (VIII)

S. niveocremeum (v. Höhn. & Litsch.) John Erikss. (VIII)
S. suecicum Litsch. ex John Erikss. (VIII)

Cristella Pat. emend. Donk

C. alnicola (Bourd. & Galz.) Donk
C. candidissima (Schw.) Donk ap. W. B. Cooke
C. confinis (Bourd. & Galz.) Donk
C. farinacea (Pers. ex Fr.) Donk
C. fastidiosa (Pers. ex Fr.) Brinkm.
C. stellulata (Bourd. & Galz.) Donk
C. sulphurea (Pers. ex Fr.) Donk
Grandinia lunata Romell ap. Bourd. & Galz.
Sistotrema variecolor (Bourd. & Galz.) Wakef. & Pears.

Xenasma Donk.

X. minutum John Erikss. (VIII)
X. pruina (Bourd. & Galz.) John Erikss. (VIII)
X. pseudotsugae (Burt) John Erikss. (VIII)
X. rimicola (Karst.) Donk
X. tenuiculum (Litsch.) John Erikss. (VIII)
X. tulasnelloideum (v. Höhn. & Litsch.) Donk
Corticium filicinum Bourd.
C. subflavidogriseum Litsch.

Paullicorticium John Erikss. (VIII)

P. allantosporum John Erikss. (VIII)
P. Pearsonii (Bourd.) John Erikss. (VIII)

Repetobasidium John Erikss.

R. mirificum John Erikss. (VIII)
R. vile (Bourd. & Galz.) John Erikss. (VIII)

Galzinia Bourd.

G. pedicellata Bourd.
Corticium incrustans v. Höhn. & Litsch.

Scytinostroma Donk

S. galactinum (Fr.) Donk
S. odoratum (Fr. ex Fr.) Donk
S. portentosum (Berk. & Curt.) Donk
S. praestans (H. S. Jacks.) Donk

Vararia Karst.

V. granulosa (Pers. ex Fr.) Laurila
V. investiens (Schw.) Karst.
V. ochroleuca (Bourd. & Galz.) Lundell ap. Lundell & Nannf.

Laeticorticium Donk

L. jonides (Bres.) Donk
L. Lundellii John Erikss. (VIII)
L. polygonioides (Karst.) Donk
L. roseum (Pers. ex Fr.) Donk

Gloeocystidiellum Donk

G. citrinum (Pers.) Donk
G. convolvens (Karst.) Donk
G. furfuraceum (Bres.) Donk
G. heterogeneum (Bourd. & Galz.) Donk
G. Karstenii (Bourd. & Galz.) Donk
G. lactescens (Berk.) Boidin
G. lividocoeruleum (Karst.) Donk
G. luridum (Bres.) Boidin
G. Nannfeldtii John Erikss. (IX)
G. ochraceum (Fr. ex Fr.) Donk
G. porosum (Berk. & Curt.) Donk
Corticium subasperisporum Litsch.

Laxitextum Lentz

L. bicolor (Pers. ex Fr.) Lentz

Aleurodiscus Rabh.

A. acerinus (Pers. ex Fr.) v. Höhn. & Litsch.
A. alliaceus (Quél.) Boidin
A. amorphus (Pers. ex Fr.) Rabh.
A. aurantius (Pers.) Schroet.
A. fennicus Laurila
A. hiemalis (Laurila) John Erikss. (VIII)
A. lapponicus Litsch.

Vuilleminia Maire

V. comedens (Nees ex Fr.) Maire

Cytidia Quél.

C. flocculenta (Fr.) v. Höhn. & Litsch.
C. salicina (Fr.) Burt

Tubulicrinis Donk

T. accedens (Bourd. & Galz.) Donk
T. angustus (Rogers & Weres. ap. Weres.) Donk
T. borealis John Erikss. (VIII)
T. calothrix (Pat.) Donk
T. chaetophorus (v. Höhn.) Donk
T. hirtellus (Bourd. & Galz.) John Erikss. (VIII)
T. inornatus (H. S. Jacks.) Donk
T. juniperinus (Bourd. & Galz.) Donk
T. subulatus (Bourd. & Galz.) Donk

Athelia Pers. emend. Donk

A. bispora (Schroet.) Donk
A. decipiens (v. Höhn. & Litsch.) John Erikss. (VIII)
A. epiphylla Pers.
A. fuscostrata (Burt.) Donk
A. Galzini (Bourd.) Donk
A. mutabilis (Bres.) Donk
A. Neuhoffii (Bres.) Donk
A. pellicularis (Karst.) Donk
A. septentrionalis John Erikss. (VIII)
A. tessulata (Cke) Donk
A. violascens (Fr. ex Fr.) Donk
Corticium bicolor Peck
C. byssinum (Karst.) Mass.
C. cremeoisabellinum Litsch.
C. molle Bres.
C. reticulatum Litsch.
C. sublaeve Bres.
C. subillaqueatum Litsch.
C. viride (Link) Bres.
Merulius fusisporus Romell
M. molluscus Fr.

Byssocorticium Bond. & Sing.

B. atrovirens (Fr.) Bond. & Sing.
Corticium pulchrum Lundell ap. Lundell & Nannf.

Tylosperma Donk

T. asterophorum (Bon.) Donk
T. fibrillosum (Burt) Donk

Phlebia Fr. emend. Donk

Ph. aerugineolivida (Romell ap. Lundell) Donk
Ph. albida v. Post ap. Fr.
Ph. centrifuga Karst.
Ph. gigantea (Fr. ex Fr.) Donk
Ph. livida (Pers. ex Fr.) Bres.
Ph. ochraceofulva (Bourd. & Galz.) Donk
Ph. radiata Fr.
Ph. Roumegueri (Bres.) Donk
Ph. subserialis (Bourd. & Galz.) Donk
Corticium deflectens (Karst.) Karst.
C. furfuraceum Bres.
C. nitidulum Karst.
C. pallidocremeum Litsch.
C. pallidoincarnatum Litsch.
C. pallidolivens Bourd. & Galz.
C. sublilascens Litsch.
C. umbratum Bourd. & Galz.
Gloeocystidium triste Litsch. & Lundell ap. Litsch.
Peniophora cornea (Bourd. & Galz.) John Erikss. ap. Lundell & Nannf.
P. femsjoeensis Litsch.
P. flavoferruginea (Karst.) Litsch.
P. guttulifera (Karst.) Sacc.
P. hydnoides Cke & Massee ap. Massee
P. martiana (Berk. & Curt.) Burt
P. pubera (Fr.) Sacc.
P. Romellii Litsch. ap. Bourd. & Galz.
P. subcalcea Litsch.
Merulius rufus Pers. ex Fr.

Mycoacia Donk

M. fuscoatra (Fr.) Donk
M. pinicola John Erikss. (III)
M. stenodon (Pers.) Donk
M. uda (Fr.) Donk

Membranicium John Erikss. ad int. (VIII)

Peniophora affinis Burt.
P. cremea (Bres.) Sacc. & Syd.
P. sanguinea (Fr.) v. Höhn. & Litsch.
P. velutina (DC. ex Pers.) Cke
Corticium tuberculatum Karst.

Peniophora Cke emend. Donk

P. cinerea (Pers. ex Fr.) Cke
P. Erikssonii Boidin
P. incarnata (Pers. ex Fr.) Karst.
P. junipericola John Erikss. (V)
P. laeta (Fr.) Donk
P. Laurentiii Lundell ap. Lundell & Nannf.
P. limitata (Fr.) Cke
P. lycii (Pers.) v. Höhn. & Litsch.
P. nuda (Fr.) Bres.
P. pithya (Pers.) John Erikss. (V)
P. polygonia (Pers. ex Fr.) Cke
P. quercina (Pers. ex Fr.) Cke
P. rufomarginata (Pers.) Litsch.
P. septentrionalis Laurila
P. suecica Litsch.
P. violaceolivida (Sommerf.) Massee

Sterellum Karst.

S. pini (Schleich. ex Fr.) Karst.
S. rufum (Fr.) John Erikss. (VIII)

Hyphoderma Wallr. emend. Donk

H. argillaceum (Bres.) Donk
H. clavigerum (Bres.) Donk
H. definitum (Jacks.) Donk
H. mutatum (Peck) Donk
H. obtusum John Erikss. (VIII)
H. pallidum (Bres.) Donk
H. polonense (Bres.) Donk
H. radula (Fr. ex Fr.) Donk
H. roseocremeum (Bres.) Donk
H. setigerum (Fr.) Donk
H. tenue (Pat.) Donk
H. teutoburgense (Brinkm.) John Erikss. (VIII)

Hypochnicium John Erikss. (VIII)

H. analogum (Bourd. & Galz.) John Erikss. (VIII)
H. bombycinum (Sommerf. ex Fr.) John Erikss. (VIII)
H. geogenium (Bres.) John Erikss. (VIII)
H. Lundellii (Bourd. ap. John Erikss.) John Erikss. (VIII)
H. punctulatum (Cke) John Erikss. (VIII)
H. sphaerosporum (v. Höhn. & Litsch.) John Erikss. (VIII)

Hyphodontia John Erikss. (VIII)

H. abieticola (Bourd. & Galz.) John Erikss. (VIII)
H. alienata (Lundell) John Erikss. (VIII)
H. alutacea (Fr.) John Erikss. (VIII)
H. alutaria (Burt) John Erikss. (VIII)
H. arguta (Fr.) John Erikss. (VIII)
H. aspera (Fr.) John Erikss. (VIII)
H. barba-jovis (Sw. ex Fr.) John Erikss. (VIII)
H. detritica (Bourd.) John Erikss. (VIII)
H. floccosa (Bourd. & Galz.) John Erikss. (VIII)
H. hastata (Litsch.) John Erikss. (VIII)
H. nivea (Bres.) John Erikss. (VIII)
H. pallidula (Bres.) John Erikss. (VIII)
H. pilaecystidiata (Lundell) John Erikss. (VIII)
H. quercina (Fr.) John Erikss. (VIII)

H. breviseta (Karst.) John Erikss. (VIII)
H. bugellensis (Ces. ap. Klotzsch-Rabh.) John Erikss. (VIII)
H. crustosa (Pers. ex Fr.) John Erikss. (VIII)
H. sambuci (Pers. ex Pers.) John Erikss. (VIII)
H. subalutacea (Karst.) John Erikss. (VIII)

Amphinema Karst.

A. byssoides (Pers. ex Fr.) John Erikss. (VIII)

Fibricium John Erikss. (VIII)

F. Greschikii (Bres.) John Erikss. (VIII)
F. lapponicum John Erikss. (VIII)

Corticium sect. *Laeta* Bourd. & Galz.

C. hypnophilum Karst.
C. laetum (Karst.) Bres.

Corticium Fr. (artificial genus)

Genuina (natural group)

C. confluens (Fr. ex Fr.) Fr.
Radulum rude (Pers.) Lundell

Spuria (artificial group)

Corticium albocremeum v. Höhn. & Litsch.
C. cebennense Bourd.
C. commixtum Litsch.
C. contiguum Karst.
C. delectabile Jacks.
C. evolvens (Fr. ex Fr.) Fr.
C. laceratum Litsch.
C. sulphurellum v. Höhn. & Litsch.
C. vellereum Ell. & Craig.
Gloeocystidium lapponicum Litsch.
Grandinia helvetica (Pers.) Fr.
G. mutabilis (Pers.) Bourd. & Galz.
Peniophora abietis Bourd. & Galz.
P. candida (Pers. ex Fr.) Lyman
P. crassa Burt
P. danica M. P. Christ.
P. longispora (Pat.) v. Höhn.
P. luna Romell ap. Rogers & Jacks.
P. nivea (Karst.) Bres. ap. Bourd. & Galz.
P. subsulphurea (Karst.) v. Höhn. & Litsch.
P. sulphurina (Karst.) v. Höhn. & Litsch.
P. viridis (Preuss) Bres.

Dacryobolus Fr.

D. sudans (A. & S. ex Fr.) Fr.

Odontia Fr. (artificial genus)

O. bicolor (A. & S. ex Fr.) Fr.
O. macrodon (Pers. ex Fr.) Bourd. & Galz.
O. Romellii Lundell & John Erikss. ap. John Erikss. (VIII)
Radulum mucidum (Pers.) Bourd. & Galz.

Merulius Fr. (artificial genus)

M. borealis Romell
M. corium Fr.
M. serpens Tode ex Fr.
M. tremellosus Pers. ex Fr.

Stereum Fr. (artificial genus)

Genuina (natural group)

S. fasciatum (Schw.) Fr.
S. gausapatum (Fr.) Fr.
S. hirsutum (Willd. ex Fr.) Fr.
S. rugosum (Pers. ex Fr.) Fr.
S. sanguinolentum (A. & S. ex Fr.) Fr.

Spuria (artificial group)

S. frustulatum (Pers. ex Fr.) Fuck.
S. Murraii (Berk. & Curt.) Burt
S. purpureum (Pers. ex Fr.) Fr.
S. sulcatum Burt

Lopharia Kalchbr. & McOwan

Stereum abietinum (Pers. ex Fr.) Pers.
S. Chailletii (Pers. ex Fr.) Fr.
Peniophora laevigata (Pers. ex Fr.) Pers.

Podoscypha Pat.

P. undulata (Fr.) Maire

Plicatura Peck

P. nivea (Fr.) Karst.

Cotylidia Karst.

C. vitellina (Plowr.) Lundell

Thelephoraceae.

Tomentella Pat.

T. atroviolacea Litsch.
T. badiofusca Bourd. & Galz.
T. bombycina (Karst.) John Erikss. (VIII)
T. Bresadolae (Brinkm. ap. Bres.) Bourd. & Galz.
T. castanea (Bourd. & Galz.) Donk
T. coriaria (Peck) Bourd. & Galz.
T. Donkii Litsch.
T. echinospora (Ell.) Bourd. & Galz.
T. fuscella (Sacc.) Lundell ap. Lundell & Nannf.
T. fuscocinerea (Pers.) Donk
T. Galzini Bourd.
T. granosa (Bres.) Bourd. & Galz.
T. griseoumbrina Litsch. ap. Lundell & Nannf.
T. Jaapii (Bres.) Bourd. & Galz.
T. livida Litsch.
T. macrospora v. Höhn. & Litsch.
T. mucidula (Karst.) v. Höhn. & Litsch. f. *lavandulacea* (Pears.)
T. mutabilis Bourd. & Galz.
T. pallidofulva (Peck) Litsch.
T. punicea (Alb. & Schw.) Schroet.
T. Ruttneri Litsch.
T. subclavigera Litsch.
T. umbrina (Fr.) Litsch. f. *sitnensis* (Bres.)

Thelephora Ehrh. ex Fr.

Th. anthocephala (Bull. ex Fr.) Fr.
Th. atra Weinm.
Th. caryophyllea Schaeff. ex Fr.
Th. mollissima Pers. ex Fr.
Th. palmata Scop. ex Fr.
Th. terrestris Ehrh. ex Fr.

Caldesiella Sacc.

C. ferruginosa (Fr.) Sacc.

Hymenochaetaceae.

Asterostroma Massee

A. laxum Bres.

A. medium Bres.

Asterodon Pat.

A. ferruginosus (Fr.) Pat.

Hymenochaete Lév.

H. cinnamomea (Pers.) Bres.
H. corrugata (Fr. ex Pers.) Lév.
H. fuliginosa (Pers.) Lév.
H. rubiginosa (Schrad. ex Fr.) Lév.
H. tabacina (Sow. ex Fr.) Lév.

Coniophoraceae.

Jaapia Bres.

J. argillacea Bres.

J. ochroleuca (Bres. ap. Brinkm.) Nannf. & J. Erikss. (VIII)

Coniophora Karst.

C. arida (Fr.) Karst.
C. fusispora (Cke & Ell.) Cke
C. olivacea (Fr.) Karst.
C. puteana (Schum. ex Fr.) Karst.

Amaurodon J. Schroet.

A. viridis (Alb. & Schw. ex Fr.) J. Schroet.

Coniophora mustialaensis (Karst.) Massee

Serpula S. F. Gray

S. himantioides (Fr.) Bond.
S. lacrymans (Schum. ex Fr.) S. F. Gray
S. pinastri (Fr.) Bond.
Merulius tignicola Harmsen
M. vastator Fr.

Hydnaceae.

Steccherinum S. F. Gray

S. fimbriatum (Pers. ex Fr.) John Erikss. (VIII)
S. Litschaueri (Bourd. & Galz.) John Erikss. (VIII)
S. ochraceum (Fr.) S. F. Gray
S. robustior (John Erikss. & Lundell) John Erikss. (VIII)

Clavariaceae.

Ramaricium John Erikss. (VII)

R. occultum John Erikss. (VII)

Kavinia Pilát

K. himantia (Schw.) John Erikss. (VIII) *Hydnum alboviride* Morg.

Mucronella Fr.

M. calva (A. & S. ex Fr.) Fr.

CORRECTIONS AND ADDITIONS

1 p. 17: between *Mycoacia* and *Polyporus* should be inserted:

Merulius corium Fr. På *Prunus avium* (867)
M. molluscus Fr. På barrved (732)
M. rufus Pers. ex Fr. På ek (868)
M. tremellosus Pers. ex Fr. På lövved (944)

V p. 16: Östergötland, should be Södermanland.
p. 75: Eriksson, J. 1848, should be 1948.

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